

General Biology

Unit 3 Pre-Test

Short essay questions (80%)

(4 pts each, 80 pts total) Write a brief essay answering each of the following questions. Provide enough details to demonstrate your understanding of each topic and concept.

- 1.) Compare and contrast catabolic and anabolic pathways. Give an example of each.

catabolic \rightarrow energy releasing breaking down large molecules into smaller ones. ΔG , spontaneous exergonic. Ex: Glycolysis, Krebs Cycle, fat metabolism

Anabolic \rightarrow energy absorbing builds big molecules from small, $+ \Delta G$, not spontaneous, endergonic Ex: Calvin cycle,

- 2.) During a recent swim meet, Nate climbed a 50 foot tall ladder onto the highest platform in preparation for his dive. After executing a perfect "cannonball" scream, he jumps - with arms and legs flailing wildly - down towards the water below.

kinetic \rightarrow energy of movement potential \rightarrow energy of position fat/protein synthesis
Describe the energy transition in terms of kinetic and potential energies.



- ① Kinetic energy converted into potential as you climb ladder.
- ② Max potential energy
- ③ Potential converts into kinetic

- 3.) What is the law of conservation of energy? How is this observed within a reaction or series of reactions?

Law of conservation of energy \rightarrow Energy cannot be created or destroyed.

initial energy \rightarrow product energy + released energy

- 4.) Describe entropy and state its relevance to the universe.

Entropy - disorder \rightarrow probability function \rightarrow maximizing degrees of freedom.

Every reaction/exchange of energy increases the entropy of the universe.

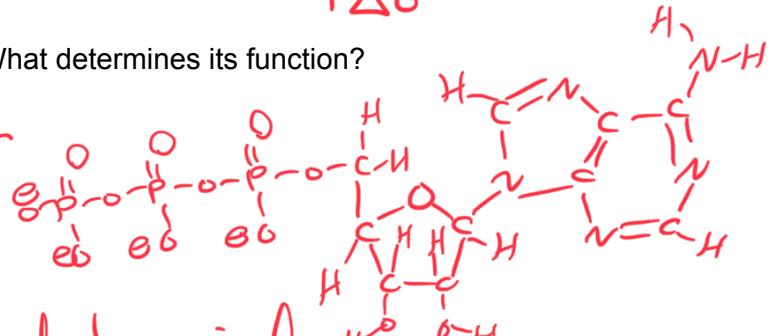
- 5.) Describe the role of adenosine triphosphate (ATP) in the cell. Be as detailed as possible.
Draw it.just kidding. (5 pts extra credit for drawing ATP)

Hydrolysis of ATP $\text{ATP} \rightarrow \text{ADP} + \text{Pi}$ yields free energy that can drive anabolic reactions in the cell.

$$+ \Delta G$$

- 6.) What is the role of an enzyme? What determines its function?

Enzyme-catalyzes a reaction speeds up by lowering the activation energy



Enzyme's function is determined by shape.

- 7.) What are the ~~three~~ main ways to denature an enzyme?

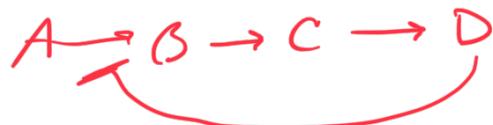
heat, pH (chaotropes)

- 8.) Explain the difference between a competitive and noncompetitive inhibitor.

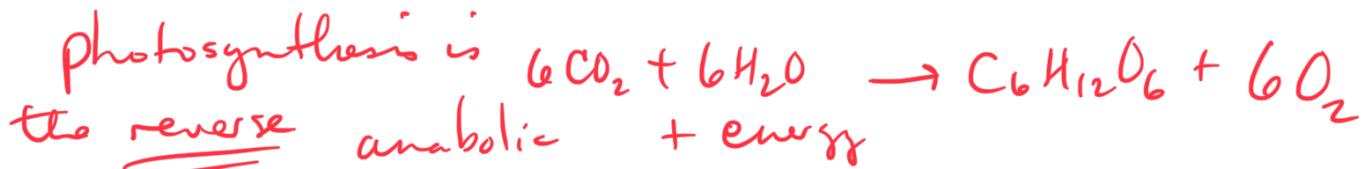
Competitive inhibitor blocks the active site and is the same shape as the substrate (analog), while noncompetitive interacts at a site other than the active site that

- 9.) What is feedback inhibition? Why is it useful?

Occurs when an end product [causes the active site feedback and inhibits an earlier reaction to conserve energy] to change.



- 10.) Compare and contrast (in general terms) the main chemical reactions used in cellular respiration and photosynthesis.



- 11.) Compare and contrast oxidation and reduction.

OIL RIG

oxidation is the loss of electrons

reduction is the gain of electrons

reduced compounds have greater energy.

- 12.) Briefly describe glycolysis. What is involved? What is the initial compound? What are the end products? Where does it take place?

Starts Glucose — end pyruvate An exergonic reaction
in cytosol that is not
dependent on oxygen. Just the cutting of sugar
Produces a net of 2 ATP

- 13.) Compare and contrast substrate-level phosphorylation and oxidative phosphorylation.

substrate-level - ATP is produced within reaction.
oxidative - ATP is generated through a series
of redox reactions which result in the
production of H^+ gradient that
moves a ATP mill (ATP synthase) with
oxygen as the terminal electron acceptor.³

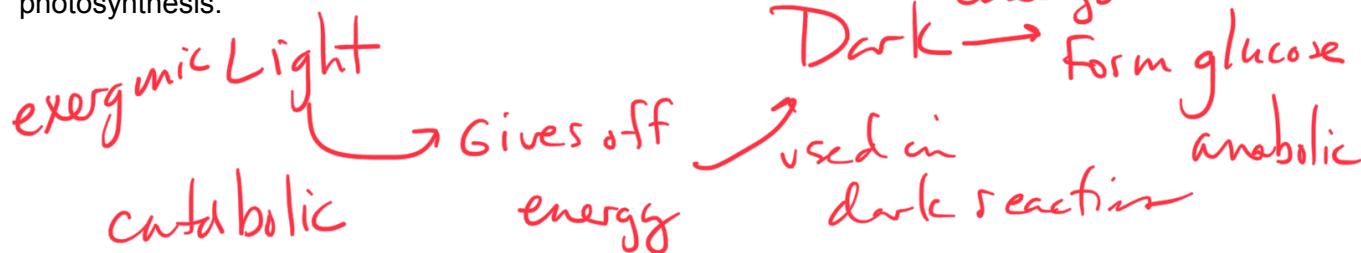
- 14.) What is chemiosmosis? How does this relate to electron transport and ATP production?

A process in which the movement of electrons produces a proton gradient which generates ATP through ATP synthase using oxygen as the terminal electron acceptor.

- 15.) Compare and contrast photoautotrophs and heterotrophs.

photoautotroph — uses light, carbon from CO_2
heterotroph — gets carbon by ingesting it.
cannot "fix" carbon from carbon dioxide

- 16.) Describe the interconnectivity between the light and dark reactions of photosynthesis.

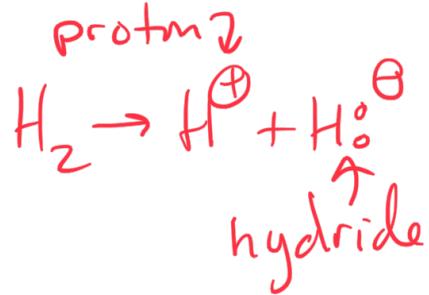


- 17.) What is the relationship between frequency and wavelength? Which has a higher energy?

↑ frequency wavelength inversely related
higher the frequency, higher the energy.

- 18.) Why are plants green? How does this relate to light absorption in photosynthesis?

Plants don't absorb green light → bounces off. Photosynthesis absorbs reds, purples, blues — not green.



- 19.) What is the purpose of water in photosynthesis?

Water donates electrons

- 20.) What is meant by electron excitation? How does this relate to the photosystem mechanism?

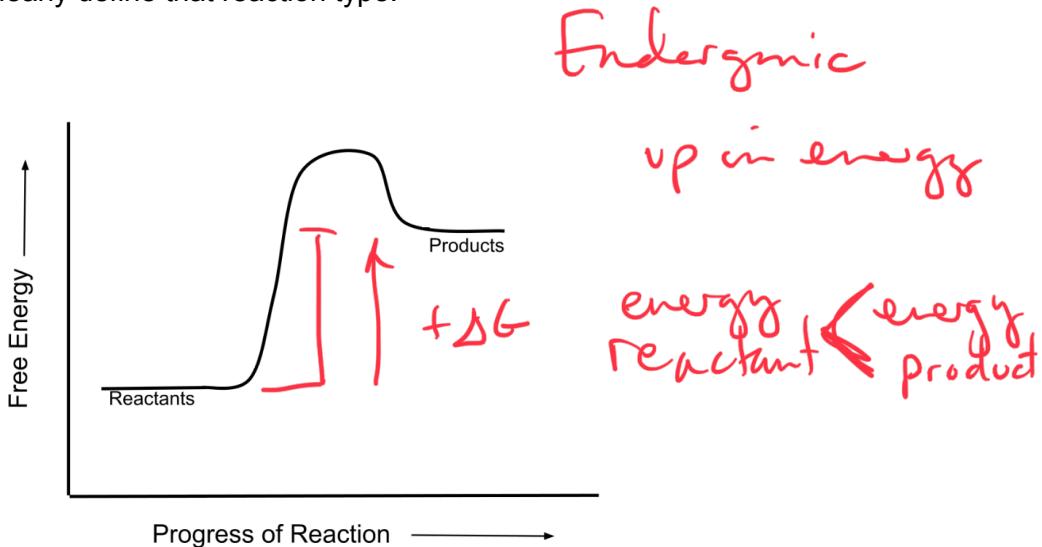
Electron excitation - electron receives energy from a photon - increases speed and goes to a higher energy orbital. Photosynthesis starts by the displacement of excited electrons.



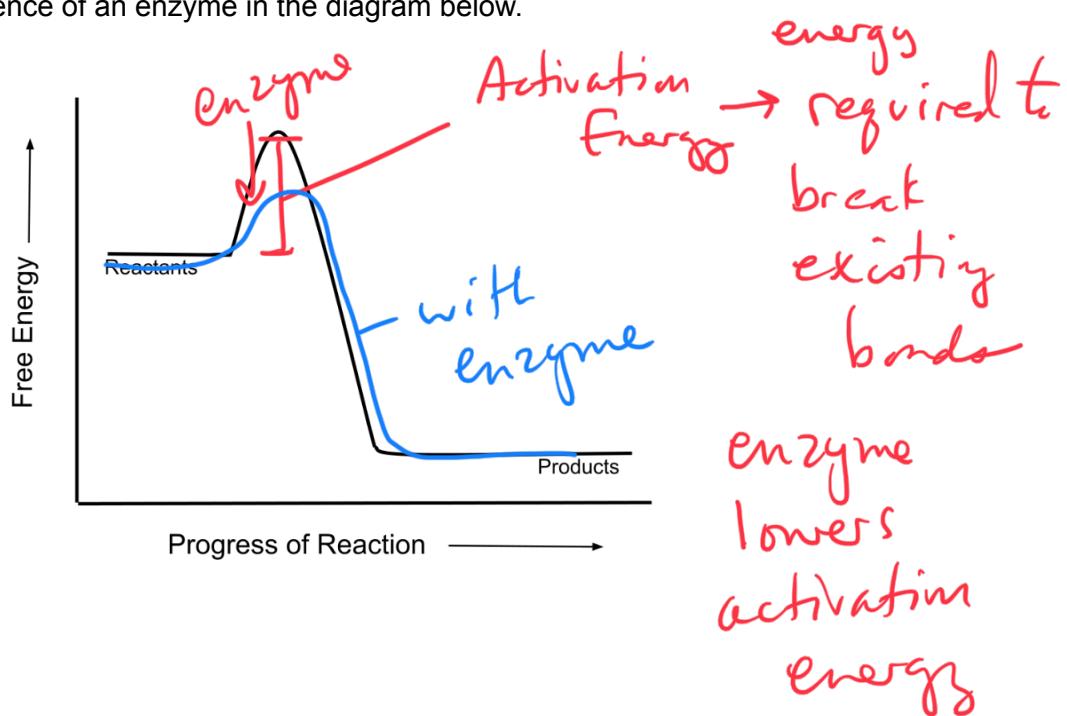
Diagrams (20%)

(5 pts each, 20 pts total) Answer each as completely as possible.

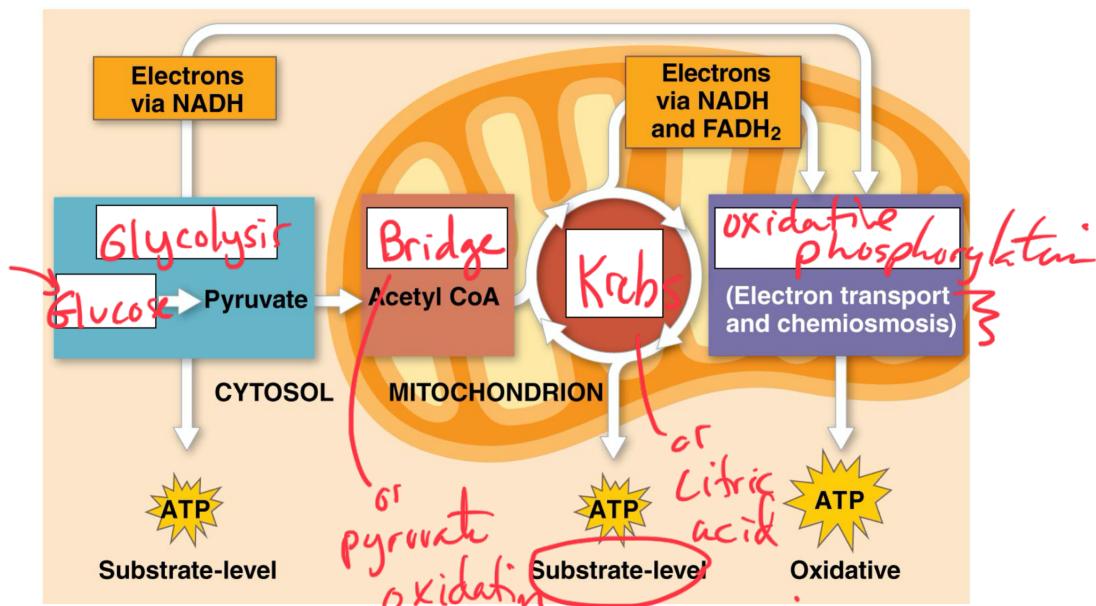
- 21.) Does the diagram below depict an exergonic or endergonic reaction? State your reasoning why and clearly define that reaction type.



- 22.) Show the influence of an enzyme in the diagram below.



- 23.) Complete the diagram below. Fill in each of the missing compound names and reactions.



- 24.) How many ATP are produced in a typical human cell from a single initial product during cellular respiration?

1 glucose → 32 ATP